



Climate Change Research Initiative

Aerosols, Clouds, and Climate Change

Addresses

NOAA Mission Goal #2

Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond

What is requested?

NOAA requests an increase of +\$6.5M and 0 FTE for observation and modeling of aerosol interaction with clouds to improve predictive understanding of how aerosols influence climate. Research conducted in this initiative will fill one of the largest information gaps in our current understanding of the factors that influence climate change. This is a new five-year focused initiative to assess and substantially reduce the uncertainty in climate simulations with an improved characterization of how aerosols affect cloud properties. The increase will complement NOAA's ongoing research of the direct climatic heating and cooling influences of aerosols. Furthermore, the research will support quick-response decision-making that is a high priority in the Nation's efforts to address climate-change issues.

Why do we need it?

Aerosols, small particles in the atmosphere, pose the largest measurement uncertainty in projecting climate change, and are believed to have climate impacts comparable in magnitude to greenhouse gasses. The effect of aerosols on cloud properties is recognized as the largest single contributor to uncertainty in predicting climate change due to human influences. A better understanding of this phenomenon is one of the Nation's top three climate-research priorities, as outlined in the National Aerosol Climate Interaction Program in 2002 and the President's U.S. Climate Change Science Program (CCSP) in 2002, and further recognized in the National Research Council's 2001 findings on climate change science. With ongoing research on direct heating and cooling by aerosols, NOAA has built the intellectual underpinning and the expertise in aerosol research needed to address the issue of aerosols, clouds, and climate change.

Reductions in emissions of fine particles offer a way to diminish human-induced climate change in the coming decades. While greenhouse gases are monitored to high precision, aerosols are not measured accurately enough to determine annual and decadal changes in their impacts on climate. There are many types of aerosols, arising from a variety of natural and human-influenced sources, and having various physical and chemical properties. Study of aerosol influence on cloud properties will resolve this scientific uncertainty in global climate models and support effective policy choices for monitoring, predicting, and minimizing human-induced climate change resulting from aerosol emissions.

Aerosols, Clouds, and Climate Change At-a-Glance

What: +\$6.5 M increase
Why: The effect of aerosols on cloud properties is the largest single contributor to uncertainty in predicting anthropogenic climate change.



What will we do?

The approach of the research program will include integrated field measurements, laboratory studies, modeling, and assessments, carried out by NOAA Research laboratory scientists and U.S. university partners. Specifically, this will involve: (1) observation-based determinations of the effect of aerosols on cloud brightness during FY 2005 and FY 2006 field studies over oceans close to the Northeastern U.S. and a continental site in the Eastern U.S.; (2) quantification of basic processes involved in aerosol effects on clouds by controlled laboratory studies and dedicated field activities; (3) building a detailed model of the microphysics and aerosol-cloud-radiation interactions using information gained from the studies in tasks (1) and (2); and (4) incorporation of aerosols' impact on climate in global climate models and comparing model results with observations to improve the models' performance.

What are the benefits?

The initiative aims to substantially augment NOAA aerosol-climate research to include the aerosols/clouds component, thereby aiming to fill a key gap in the current scientific understanding of one of the major factors that affects climate. Over the next five years, NOAA will improve the observations and model-simulation of the connection between aerosols and climate change. The goal is to assess and substantially reduce the uncertainty in climate simulations with an improved characterization of how aerosols affect cloud properties, in both the near-term and the end-of-the-decade timescales associated with the CCSP, Climate Change Research Initiative, and U.S. Global Change Research Program goals. This research will address what is currently the most uncertain of the factors that influence climate change.

The Aerosols, Clouds, and Climate Change research program will integrate field studies, laboratory characterization, diagnostic modeling, and decision-support assessment into an end-to-end discovery-information product. In addition to improving capability to simulate global and regional climate change and determine the roles of various aerosols in climate change, the results will help scientists assess and improve the reliability of future climate projection scenarios for the CCSP and Intergovernmental Panel on Climate Change (IPCC), and craft the next generation of decision-support needs. The research results will timely meet requirements for inclusion in the 2006 - 2007 CCSP and IPCC assessments. This research will also pave the way for a NOAA-sponsored community-wide assessment of aerosol-related, climate-forcing predictive skills, which will be a major deliverable for global decision-making, underscoring two decades of U.S. global change research. Since many of the emissions that lead to aerosols are pollutants that contribute to human health issues, an understanding of aerosol effect on cloud properties and climate change could support policy decisions for emission reductions that have both climate and human health benefits.

For more
information:

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FY 2005 Proposed Climate Change Research Initiative Program Components:

- Global Ocean Observing System
- Carbon Cycle Atmospheric Observing System
- Aerosols, Clouds, and Climate Change
- Climate Change Computing Initiative



Office of Oceanic and Atmospheric Research
Climate Observations and Services
Climate Change Research Initiative

NOAA Budget
FY 2005
Change

Aerosols, Clouds,
and Climate Change
+\$6.5M
(\$8.6M total)

